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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
BOYER, RANDY	

ART UNIT	PAPER NUMBER
1797	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/784,432	PAXTON ET AL.	
	Examiner	Art Unit	
	RANDY BOYER	1797	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 February 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-44* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *15-22* is/are allowed.

6)☒ Claim(s) *1-12,14,23,24,27-33,37,38 and 42-44* is/are rejected.

7)☒ Claim(s) *1,13,19,25,26,34-36 and 39-41* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *23 June 2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement filed 23 June 2004 fails to comply with the provisions of 37 CFR 1.97, 1.98 and MPEP § 609 because the reference(s) do not include a publication date. It has been placed in the application file, but the information referred to therein has not been considered as to the merits. Applicant is advised that the date of any re-submission of any item of information contained in this information disclosure statement or the submission of any missing element(s) will be the date of submission for purposes of determining compliance with the requirements based on the time of filing the statement, including all certification requirements for statements under 37 CFR 1.97(e). See MPEP § 609.05(a).

2. Examiner notes that the information disclosure statement filed 23 June 2004 has been considered in part, as evidenced by Examiner's initialing of those references considered.

3. However, the reference by W.F. Paxton et al. (entitled "Autonomous Movement of Striped Nanorods") has *not* been considered because no date of publication has been provided for this reference.

Claim Objections

4. Claim 1 is objected to for improper use of the English language.

5. With respect to claim 1, the claim provides in part "the fluid medium having a fluid component provides a chemical reaction . . .". The cited portion is incorrect English because it is missing a necessary conjunction. Appropriate correction is required.

6. Claim 19 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

7. Claim 19 is dependent on claim "B4." Examiner notes that there is no such claim "B4." Appropriate correction is required.

Claim Rejections - 35 USC § 102 / 35 USC § 103

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office Action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

11. Claims 1 and 12 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Montemagno (WO 00/22101 A2).

12. With respect to claim 1, Montemagno discloses a method of providing relative motion between a microstructure (F_1-ATPase) and a fluid medium (water), the method comprising: (a) providing a catalyst region (β subunit) within the microstructure (F_1-ATPase); (b) providing a non-catalyst region (α subunit) within the microstructure (F_1-ATPase), the non-catalyst region (α subunit) having an adjacent non-catalyst portion that is substantially adjacent to the catalyst region (β subunit); (c) providing a fluid medium (water), the fluid medium (water) having a fluid component (water, ATP) that provides a chemical reaction (hydrolysis of ATP), the chemical reaction (hydrolysis of ATP) being catalyzed by the catalyst region (β subunit); and (d) exposing the microstructure (F_1-ATPase) to the fluid medium (water), so that the catalyst region (β subunit) and the adjacent non-catalyst portion are both exposed to the fluid medium (water); wherein the chemical reaction (hydrolysis of ATP) induces the relative motion

between the fluid medium (water) and the microstructure (F_1-ATPase) (see Montemagno, pages 8-13; and Fig. 1 and Fig. 3 with accompanying text).

13. With respect to claim 12, Montemagno discloses an analyte binding agent (His tag) on the adjacent non-catalyst region, the relative motion being modified by the binding of an analyte (zinc) within the fluid medium (water) to the analyte binding agent (His tag) (see Montemagno, pages 29-31).

14. Claims 1-11, 14, 23, 24, 27-33, 37, 38, and 42-44 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Ismagilov (R.F. Ismagilov et al., *Autonomous Movement and Self-Assembly*, 41 ANGEW. CHEM. INT. ED. 652-654 (2004)).

15. With respect to claims 1-8, Ismagilov discloses a method of providing a relative motion between a microstructure and a fluid medium, the method comprising: (a) providing a catalyst region (e.g., comprising platinum catalyst) within the microstructure (see Ismagilov, page 652); (b) providing a non-catalyst region within the microstructure, the non-catalyst region having an adjacent non-catalyst portion that is substantially adjacent to the catalyst region (see Ismagilov, page 652; and Figure 1 with accompanying text); (c) providing a fluid medium (e.g., an aqueous hydrogen peroxide solution) (see Ismagilov, page 652), the fluid medium having a fluid component providing a chemical reaction (e.g., decomposition of hydrogen peroxide into water and oxygen) (see Ismagilov, page 652), the chemical reaction being catalyzed by the catalyst region; and (d) exposing the microstructure to the fluid medium, so that the catalyst region and the adjacent non-catalyst portion are both exposed to the fluid

medium (see Ismagilov, page 652); wherein the chemical reaction induces the relative motion between the fluid medium and the microstructure.

16. With respect to claim 9, Ismagilov explains that the motion of the microstructure is induced by the recoil of the liquid solution as the (oxygen) bubbles burst (see Ismagilov, pages 652-653). Examiner notes that the oxygen bubbles Ismagilov refers to are generated from the decomposition of hydrogen peroxide in solution (see Ismagilov, page 652). Thus, it is clear that the "autonomous motion [is] powered by the chemical reaction."

17. With respect to claims 10, 11, and 14, Ismagilov discloses wherein the relative motion is used to induce flow of fluid medium along a fluid pathway at least partially defined by the microstructure (see Ismagilov, entire disclosure); wherein the direction of relative motion is controlled by modifying a surface wetting property of the adjacent non-catalyst portion (see Ismagilov; Figure 1 and accompanying text; and page 654); and wherein the relative motion is used to induce a rotation of the microstructure (see Ismagilov, Figures 2 and 3 with accompanying text).

18. With respect to claims 23, 24, 27, and 28, Ismagilov discloses a method of providing a relative motion between a microstructure and a fluid medium, the method including: (a) providing a catalyst region (e.g., one comprising a platinum catalyst) within the microstructure (see Ismagilov, page 652); (b) providing a non-catalyst region with the microstructure (see Ismagilov, page 652); (c) exposing at least part of the microstructure to the fluid medium, so that the catalyst region and non-catalyst region are exposed to the fluid medium (see Ismagilov, entire disclosure); the fluid medium

having a fluid component (e.g., hydrogen peroxide) providing a chemical reaction (e.g., the decomposition of hydrogen peroxide into water and oxygen) catalyzed by the catalyst region (see Ismagilov, page 652); wherein the chemical reaction induces the relative motion between the microstructure and the fluid medium (see Ismagilov, pages 652-653); wherein the relative motion is provided by an interfacial tension gradient between the catalyst region and the non-catalyst region (see Ismagilov, entire disclosure); wherein the relative motion is used to power the self-powered autonomous directional motion of the microstructure through the fluid medium (see Ismagilov, entire disclosure); and wherein the self-powered autonomous directional motion of the microstructure is controlled by modifying a surface property of the non-catalyst region (see Ismagilov, Figure 1 with accompanying text; and page 654).

19. With respect to claims 29-33, Ismagilov discloses a microstructure, the microstructure providing a motion relative to a fluid medium when the microstructure is exposed to the fluid medium, the microstructure comprising: (a) a catalyst region (e.g., comprising a platinum catalyst), the catalyst region catalyzing a chemical reaction (e.g., the decomposition of hydrogen peroxide into water and oxygen) of a fluid component (e.g., hydrogen peroxide) of the fluid medium (see Ismagilov, page 652); (b) a non-catalyst region, proximate to the catalyst region (see Ismagilov, page 652); and (c) a surface layer, supported by the non-catalyst region, wherein the surface layer provides tunable surface wetting properties, the surface wettability determining the direction of the motion relative to the fluid medium (see Ismagilov, Figure 1 and accompanying text; and page 654); wherein the surface wetting properties is changeable by an external

stimulus, so as to provide a modification of the motion relative to a fluid medium; and wherein the external stimulus includes irradiation of the surface layer by electromagnetic radiation (see Ismagilov, Figure 1 and accompanying text).

20. With respect to claims 37, 38, and 42-44, Ismagilov discloses wherein the microstructure is a component of a self-powered micromachine capable of an autonomous directional motion through the fluid medium, the autonomous directional motion having a direction correlated with the surface wetting properties (see Ismgailov, entire disclosure); wherein the direction of the autonomous directional motion is changeable through a controlled change in the surface wettability (see Ismagilov, page 654); wherein the catalyst region includes a platinum metal catalyst (see Ismagilov, page 652); and wherein the catalyst region may comprise an enzyme (see Ismagilov, footnote 2).

Allowable Subject Matter

21. Claims 15-22 are allowed.

22. Claims 13, 25, 26, 34-36, and 39-41 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

23. The following is an examiner's statement of reasons for allowance:

With respect to claim 13, Ismagilov neither discloses nor suggests "wherein the relative motion [between the fluid medium and the microstructure] provides a

measurable force at a force sensor, the force sensor being used to detect a presence of [an] analyte."

With respect to claims 15-22, neither Montemagno nor Ismagilov disclose or suggest "a microgear . . . comprising . . . at least one gear tooth protruding from [a] central portion [of the microgear]."

With respect to claim 25, Ismagilov neither discloses nor suggests "the catalyst regions being disposed within radially outwardly extending portions of a substantially disk shaped microstructure operating as a microgear."

With respect to claim 26, Ismagilov neither discloses nor suggests "wherein the microstructure is a component of a microfluidic pump."

With respect to claim 34, 35, and 40, Ismagilov neither discloses nor suggests "wherein the surface layer is a self assembled monolayer."

With respect to claim 36, Ismagilov neither discloses nor suggests "wherein the surface wetting properties are changeable by an interaction between the surface layer and an analyte within the fluid medium, the interaction providing a modification of the motion relative to the fluid medium, the modification allowing detection of the analyte."

With respect to claims 39 and 41, Ismagilov neither discloses nor suggests "wherein the microstructure is a component of a sensor mechanism" or "wherein the microstructure is a component of a microfluidic device."

Conclusion

24. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Randy Boyer whose telephone number is (571) 272-7113. The examiner can normally be reached Monday through Friday from 10:00 A.M. to 7:00 P.M. (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn A. Caldarola, can be reached at (571) 272-1444. The fax number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

RPB

/Glenn A Caldarola/

Acting SPE of Art Unit 1797